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New Study Sheds Light on Stroke Recovery

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STORY AT-A-GLANCE

- Stroke occurs when a blood clot blocks an artery or blood vessel, cutting off blood flow to your brain. As a result, brain cells die and brain damage can occur. Without proper and timely treatment, a stroke can be lethal
- Estimates suggest 10% of all strokes occur in people under the age of 50, and 2.5% of strokes occur in those under the age of 20
- Studies have shown that, surprisingly, blocking inflammation after a stroke isn't beneficial. Recent research demonstrates brain inflammation following a stroke actually plays a beneficial role in neuroplasticity and recovery of function
- It's imperative to rapidly implement neurocognitive training after a stroke, as your brain circuits need the proper stimulus to reroute
- Education appears to play a role in stroke recovery by acting as a cognitive reserve against post-stroke cognitive impairment. Getting the proper nutrition after a stroke is also crucial for optimal recovery

Strokes can be divided into hemorrhagic stroke and ischemic strokes, and approximately 80% of them are ischemic brain injury. Ischemic strokes are sometimes referred to as "brain attacks" (instead of "heart attacks") because they typically occur when a blood clot blocks an artery or blood vessel, cutting off blood flow to your brain, as opposed to your heart.[1]

As a result, brain cells die and neurological damage can occur. Without proper and timely treatment, a stroke can be lethal. According to statistics published in 2020,[2] an estimated 795,000 strokes occur each year in the U.S., and in 2017, 146,383 Americans died as a result.

However, new research in 2022 shows an 11% increase in new cases of stroke that cause brain bleeding, or intracerebral hemorrhage stroke, and at a faster rate in younger to middle-age people.[3]

Stroke is also a leading cause of long-term disability in the U.S.[4] Worldwide, stroke is the second leading cause of death and the third leading cause of disability.[5] While most strokes occur in the elderly, younger people are by no means immune. Between 1995 and 2012, stroke rates nearly doubled for men between the ages of 18 and 44.[6] Among men between 35 and 44 years, the incidence rate rose by 41.5%.[7]

Estimates suggest 10% of all strokes occur in people under the age of 50,[8] and 2.5% of strokes occur in those under the age of 20.[9] The prevalence of having three to five risk factors for stroke (such as high blood pressure, diabetes, smoking and obesity) have also significantly increased since 2003.[10]

The good news is we're learning more about stroke recovery as time goes on, and there are quite a few strategies that can help improve your condition after a stroke. There are also many things you can do to prevent it in the first place.

Rapid treatment is imperative, though. As noted in the journal Stroke,[11] the ideal treatment window is within three to six hours of onset, and even then, 5% end up with long-term disabilities.

The Role of Inflammation in Post-Stroke Recovery

Ann Stowe, a scientist and lab manager at the University of Kentucky College of Medicine's department of neurology,[12] focuses her studies on the role your immune system plays in your brain's recovery after a stroke.[13] Clinical research has found that, surprisingly, blocking inflammation after a stroke isn't beneficial. Stowe told Newswise:[14]

"We reviewed a clinical trial that focused on blocking inflammation after a stroke in stroke patients, and it was a profound failure. From that point on, I've had the theory that brain inflammation is actually required for stroke recovery. It's not all detrimental."

Through her research, Stowe is trying to determine how inflammation can be manipulated to support rather than hinder neuroplasticity and recovery of function after a stroke. She explains:

"When you think about the brain and how it reorganizes after stroke, there are many areas that are involved. It's the other areas of the brain that survived the stroke that actually rewire and reorganize to support recovery. Inflammation can actually affect these other areas, too …

This study suggests that B cells might have a more healing role. Hopefully from this, we can better understand the inflammatory processes after stroke — and long term, possibly identify what subsets of immune cells can support stroke recovery."

The Importance of Humoral Immunity Post-Stroke

More recently, Stowe and colleagues found[15,16] B cells — a type of white blood cell that are part of your humoral immunity and secretes antibodies[17] — migrate into remote areas of your brain and support neurogenesis after you've had a stroke. As explained in her study:[18]

"Neuroinflammation occurs immediately after stroke onset in the ischemic infarct … We identify bilateral B cell diapedesis into remote regions, outside of the injury, that support motor and cognitive recovery in young male mice.

Post-stroke depletion of B cells confirms a positive role in neurogenesis, neuronal survival, and recovery of motor coordination, spatial learning, and anxiety … Lymphocytes infiltrate the stroke core and penumbra and often exacerbate cellular injury.

B cells, however, are lymphocytes that do not contribute to acute pathology but can support recovery. B cell adoptive transfer to mice reduced infarct volumes 3 and 7 d[ays] after transient middle cerebral artery occlusion, independent of changing immune populations in recipient mice.

Testing a direct neurotrophic effect, B cells cocultured with mixed cortical cells protected neurons and maintained dendritic arborization after oxygen-glucose deprivation …

Stroke leads to central nervous system (CNS) damage, which results in functional deficits and is exacerbated by an inflammatory immune response derived from both the innate and adaptive immune systems.

Mechanistic studies … show a significant infiltration of innate immune cells, including monocytes, macrophages, and neutrophils, predominantly in the area of ischemic injury (i.e., infarct, periinfarct regions).

The role of the adaptive immune system is also pivotal to stroke recovery, as it can both exacerbate and ameliorate long-term neuropathology, depending on the lymphocyte population, location, and timing of activation.

Location and timing are particularly relevant, as recovery of lost function in stroke patients depends on functional plasticity in areas outside of the infarct (i.e., remote cortices) to subsume lost function.

Neurons in remote cortical areas that are interconnected to the infarct up-regulate growth factors and plasticity-related genes after stroke … B cells, critical effector cells for antibody production and antigen presentation, are one adaptive immune cell subset with the capacity to also produce neurotrophins to support neuronal survival and plasticity."

Hyperbaric Oxygen Therapy — Valuable Tool in Stroke Rehab

Hyperbaric medicine, as an emerging interdisciplinary subject, has been applied in the treatment of strokes since the 1960s. Hyperbaric oxygen can be defined as the breathing of 100% oxygen at a pressure higher than atmospheric pressure.

Many have demonstrated that hyperbaric oxygen therapy (HBOT) is capable of increasing oxygen supply, improving cerebral circulation, reducing ischemia-reperfusion injury and alleviating the extent of irreversible neurological impairment.[19]

Following an ischemic stroke, in which cerebral blood flow is impaired, irreversible neurologic injury occurs within minutes.[20] Of particular interest are the regions surrounding the initial site of injury where the tissue is at risk but not facing irreparable damage, and the potential to salvage these nerves still exists.

Decreased oxygen supply to the damaged area including blood vessels further prevents tissue repair and the generation of new brain tissue. Consequently, increased oxygen has been considered as a potential treatment for stroke for several decades.[21]

The use of HBOT for brain injury is based on the hypothesis that injured or inactive nerve tissue would benefit from increased blood flow and oxygen delivery, which would act to metabolically or electrically reactivate the cell.[22]

A recent study found improvements in cognition and executive function as well as physical abilities, such as improved gait. Treated patients reported improved sleep and quality of life following HBOT treatment and had improvements in blood levels of biomarkers for inflammation and neural recovery.[23]

Advances in Stroke Recovery and Rehabilitation

As noted in the 2017 paper,[24] "Stroke Recovery & Rehabilitation Research," which represents "the collective thoughts of the NIH StrokeNet Recovery & Rehabilitation Working Group," most current post-stroke therapies "aim to maximize function in brain areas that survive the stroke, or provide compensatory approaches to improve overall function."

Many of those approaches are based on what we now know about the molecular and physiological events that arise in your nervous system in the days and weeks following a stroke. Classes of therapies available or in the works include the use of:[25]

Small molecules	Growth factors	Stem cells
Monoclonal antibodies	Brain stimulation	Robotics and other devices
Cognitive therapies	Intensive brain training	Telerehabilitation

The paper highlights the importance of concomitant behavioral training, noting "the brain circuits galvanized for rewiring need the right experience to shape them, akin to normal development."

In other words, your brain will need to relearn how to do things like eating and moving, just as if you were a young child, and without the proper stimulus, your brain will not be able to achieve the required rewiring. What's more, 80% of this recovery occurs within the first 30 days after a stroke,[26] so it's crucial to implement as many rehab strategies as possible to optimize the outcome.

For these reasons, it's crucial to know what to do as soon as you've been diagnosed with a stroke at the hospital, or even while you're in the ambulance to the hospital. In 2019, I interviewed Bob Dennis about his excellent book, "Stroke of Luck: NOW! Fast and Free Exercises to Immediately Begin Mastering Neuroplasticity Following Stroke — Right Now!"[27]

This is the book you want to have when you are in the emergency room so you can rapidly begin the process of activating your neuroplasticity and regain as much lost function from the stroke as possible.

Just as it's important to get rapid medical assistance when suffering a stroke, the sooner you begin taking steps to heal your brain after a stroke, the faster and more

complete your recovery will be. You can get the key points of the book, "Stroke of Luck," completely free, without download, simply by opening the Amazon book preview.

Education Is Neuroprotective

It's also well known that the ability to recover from a stroke varies widely from one person to the next. As noted in the paper,[28] "Stroke Recovery: Surprising Influences and Residual Consequences," "Even two individuals with very similar appearing ischemic strokes may show very different outcomes one year later."

This paper also stresses the importance of education, noting that "education might have a role in recovery … based on previous studies indicating that education may promote neuroplasticity or may have a neuroprotective effect against cognitive decline." The authors further added:[29]

> *"One study did find that the highest educational levels were associated with lower rates of post-stroke cognitive deficits and dementia and higher rates of long-term survival, independently of stroke severity, age, sex, marital status, and white matter lesions in individuals with mild/moderate ischemic stroke.*
>
> *Results were interpreted as support for the hypothesis that high education, a proxy for cognitive reserve, protects against post-stroke cognitive impairment."*

Emergency Medical Kit for Stroke

Melatonin is a profoundly powerful antioxidant that can help lower oxidative damage in strokes or heart attacks. One of the scenarios that is most devastating for the heart and brain is temporary interruption of the blood supply as a result of a cardiac arrest or stroke. This deprives the tissues of oxygen, and without oxygen, they rapidly deteriorate.

When the blood vessel reopens, which is called reperfusion, and oxygen flows back into those oxygen-deprived cells, this tends to be the time of maximum damage, as loads of free radicals are generated once the blood starts flowing again.

In cases of an acute heart attack or stroke (which have virtually identical tissue damage mechanisms, just one affects the heart and the other your brain), methylene blue. Methylene blue is well-documented to be highly beneficial for reperfusion injuries, especially if you do it right at the beginning of the event, because it augments cytochromes to allow the continued production of ATP even without the use of oxygen.

> *"Melatonin and methylene blue belong in every emergency medical kit. In cases of an acute heart attack or stroke, melatonin can help limit the damage, while methylene blue augments cytochromes to allow the continued production of ATP even without the use of oxygen, which also helps minimize cell death and tissue damage."*

So, together, methylene blue and melatonin could act as a one-two punch if you've got a stroke or heart attack. They really should be part of every emergency kit. As an interesting side note, melatonin can also be useful in people with Type 2 diabetes. Reiter notes he has diabetic colleagues who take 1 gram of melatonin daily to counteract the free radical damage caused by hyperglycemia.

Keep in mind that melatonin does not treat the cause of the diabetes. It only helps to counteract the damage being caused.

Post-Stroke Nutrition

Other studies have stressed the importance of nutrition for brain recovery after a stroke.[30] For example, the 2011 paper,[31] "Nutrition for Brain Recovery After Ischemic Stroke: An Added Value to Rehabilitation," points out the importance of protein supplementation during recovery, as protein synthesis is suppressed in the ischemic penumbra (i.e., the area of the brain surrounding the ischemic event).

It cites research showing protein supplementation enhances recovery of neurocognitive function post-stroke. B vitamins are also important, as they've been shown to mitigate oxidative damage caused by free radicals and lipid peroxidation, as is zinc. According to this paper:

> *"In clinical practice, patients with ischemic stroke were found to have a lower than recommended dietary intake of zinc. Patients in whom daily zinc intake was normalized had better recovery of neurological deficits than subjects given a placebo."*

Other important nutrients and dietary components during post-stroke rehabilitation include:

Vitamin E[32]	Vitamin C[33]
Vitamin D[34]	Magnesium[35]
Marine-based omega-3[36,37]	Fiber (fruits and vegetables)[38,39]

Certain herbal supplements may also be useful, including the following:[40]

- Ashwagandha[41,42]
- Ginseng[43,44]
- Citicoline[45]
- Ginkgo biloba[46]

Stroke Prevention Guidelines

It's important to realize that the vast majority of strokes are preventable, so your lifestyle plays a major role in whether or not you're going to become a statistic here. Lifestyle factors that can have a direct impact on your stroke risk include:

Exercise — By normalizing your blood sugar and improving your insulin and leptin receptor signaling, exercise helps normalize your blood pressure and reduce your stroke risk. If you've had a stroke, exercise is also very important, as research shows it can significantly improve both your mental and physical recovery[47] and reduce your risk of recurrent stroke.[48] For example:

A 2013 study published in Stroke[49] concluded that walking at least three hours per week reduces stroke risk in women better than inactivity, but also better than high intensity cardio.

This may have something to do with the inordinate amount of physical stress "conventional cardio" has on the heart, and the fact that people generally do too much of it for too long. Perhaps women are more susceptible to these risks than men. Conventional cardio can cause arrhythmias, and in some cases, atrial fibrillation, which is a known risk factor for stroke.

In 2009, a study in Neurology[50] found that vigorous exercise reduces stroke risk in men, as well as helping them recover from a stroke better and faster. However, moderate to heavy exercise was not found to have a protective effect for women.

Sleep — Research[51] shows that compared with sleeping seven to eight hours a night, regularly sleeping for nine hours or more can increase your stroke risk by 23%, while shorter sleep (less than six hours a night) had no significant effect on stroke risk. Taking long midday naps (more than 90 minutes) raised the risk by 25% compared to napping 30 minutes or less.

Those who both slept for nine hours or more at night and napped for more than 90 minutes were at greatest risk. This excessive sleep combination increased stroke risk by 85% compared to moderate sleepers and nappers.

On the other hand, research[52,53,54] has also found genetic predisposition to insomnia is associated with a significantly higher risk of coronary artery disease, heart failure and ischemic stroke. Genetic predisposition to insomnia was associated with a 13% increased risk of larger artery stroke, an 8% higher risk of small vessel stroke and a 6% increased risk of cardioembolic stroke.

"Diet" soda and energy drinks — Research[55] shows regular consumption of artificially sweetened "diet" soda significantly raises your 10-year stroke risk. Caffeine-loaded energy drinks can also cause your blood to become sticky, which is a precursor to

stroke. A single can of Red Bull can increase your risk of stroke fivefold, experts warn.[56,57,58]

Stress — According to a 2008 study,[59] the more stressed you are, the greater your risk of suffering a stroke. For every notch lower a person scored on their well-being scale, their risk of stroke increased by 11%. Not surprisingly, the relationship between psychological distress and stroke was most pronounced when the stroke was fatal.

My favorite overall tool to manage stress is EFT (Emotional Freedom Techniques). Other common stress-reduction tools with a high success rate include prayer, meditation, laughter and yoga, for example.

Hormone replacement therapy (HRT) and birth control pills — If you're on one of the hormonal birth control methods (whether it's the pill, patch, vaginal ring or implant), it is important to understand that you are taking synthetic progesterone and synthetic estrogen.

These contraceptives contain the same synthetic hormones as those used in hormone replacement therapy (HRT), which has well-documented risks, including an increased risk of blood clots, heart attack and stroke.

Vitamin D — According to research presented at the American Heart Association's (AHA) Annual Scientific Sessions in 2010,[60] low levels of vitamin D — the essential nutrient obtained from exposure to sunlight — doubles the risk of stroke in Caucasians. Get tested twice a year to make sure you're within the ideal range of 60 ng/mL to 80 ng/mL year-round.

Statins — Statin drugs are frequently prescribed to reduce your risk of heart disease and stroke. However, while these cholesterol-lowering drugs have been shown to lower the risk for ischemic stroke by 20% in patients with a history of cerebrovascular disease, they increase the risk of a hemorrhagic stroke by 73%.[61]

There are two reasons why this might happen: The drugs may either lower cholesterol too much, to the point that it increases your risk of brain bleeding, or they may affect clotting factors in your blood, increasing the bleeding risk.

Grounding[62] — Walking barefoot, aka "grounding," has a potent antioxidant effect that helps alleviate inflammation throughout your body. When you put your feet on the ground, you absorb large amounts of negative electrons through the soles of your feet.

High-sugar diets, smoking, radiofrequencies and other toxic electromagnetic forces, emotional stress, high cholesterol and high uric acid levels are examples of factors that make your blood hypercoagulable, meaning it makes it thick and slow-moving, which increases your risk of having a blood clot or stroke.

Grounding helps thin your blood by improving its zeta potential. This gives each blood cell more negative charge which helps them repel each other to keep your blood thin and less likely to clot. This can significantly reduce your risk of stroke.

Research has demonstrated it takes about 80 minutes, or 40 minutes over two grounding periods, for the free electrons from the earth to reach your blood stream and transform your blood, so make it a point to regularly walk barefoot on grass or on wet sand for about 1.5 to two hours, if possible.

TMAO levels — Studies have shown high levels of trimethylamine-N-oxide (TMAO) are associated with an increased risk of heart attacks and stroke,[63] so measuring your blood level of TMAO could be a powerful predictive tool for assessing your stroke risk. In one analysis,[64] high blood levels of TMAO increased the risk of dying from any cause fourfold in the next five years.

In a paper[65] led by James DiNicolantonio, Pharm.D., who is also the coauthor of my book, "Superfuel: Ketogenic Keys to Unlock the Secrets of Good Fats, Bad Fats, and Great Health," he explains how the likely true cause of elevated TMAO levels is hepatic insulin resistance.

Moreover, the paper shows that krill oil, astaxanthin, fish oil and berberine may be among some of the best supplemental strategies for those with high TMAO levels after diet optimization, as it is simply a reflection of insulin resistance in the liver.

Alcohol consumption — Research[66] shows heavy alcohol consumption in middle age can be a risk factor for stroke. Those averaging more than two drinks a day were found to have a 34% higher risk of stroke than those who averaged less than half a drink per day.

According to this study, "Midlife heavy drinkers were at high-risk from baseline until the age of 75 years when hypertension and diabetes mellitus grew to being the more relevant risk factors. In analyses of monozygotic twin-pairs, heavy drinking shortened time to stroke by five years."

Smoking — As one of the major risk factors for stroke, quitting smoking is an important consideration if you're concerned about your stroke risk.

Sauna — Long-term research[67] shows that, compared to sauna bathing just once a week, those who take a sauna four to seven times a week lower their risk of stroke by as much as 61%.

How to Recognize a Stroke

A stroke doesn't advertise its pending arrival, which makes prevention all the more important. That said, getting medical help quickly can mean the difference between life and death or permanent disability, should you or someone you love suffer a stroke. This is an area where conventional medicine excels, so please do not delay in getting medical attention.

Nine out of 10 strokes are ischemic strokes,[68] which result from an obstruction in a blood vessel supplying blood to your brain. The other form of stroke is known as a

hemorrhagic stroke, which is when a blood vessel actually ruptures, which can lead to rapid death. The five-year survival rate for hemorrhagic stroke is only 26.7%.[69]

In the case of ischemic stroke, there are emergency medications that can dissolve a blood clot that is blocking blood flow to your brain. If done quickly enough, emergency medicine can prevent or reverse permanent neurological damage, but you typically need treatment within one hour, which means the faster you recognize the signs, the better the prognosis.

Research also shows primary stroke centers have lower mortality than other hospitals,[70] so if a stroke is suspected, be sure to ask them to take the patient to a primary stroke facility. The following symptoms can signal a lack of oxygen to your brain, which could be due to a stroke:

- Sudden numbness or weakness of face, arm or leg, especially when occurring on one side of the body; face drooping, typically on just one side
- Sudden confusion; trouble talking or understanding speech
- Sudden trouble seeing in one or both eyes, or double vision
- Sudden trouble walking, dizziness or loss of balance or coordination
- Sudden severe headache with no known cause; nausea or vomiting

The National Stroke Association recommends using the FAST acronym to help remember the warning signs of stroke.[71] If any of these occur, call for immediate emergency medical assistance (in the U.S., call 911):

F = FACE — Ask the person to smile. Does one side of the face droop?

A = ARMS — Ask the person to raise both arms. Does one arm drift downward?

S = SPEECH — Ask the person to repeat a simple phrase. Does their speech sound slurred or strange?

T = TIME — If you observe any of these signs, it's time to call 911.

It's important to pay attention to these symptoms even if they last only a short time and suddenly disappear, as it could be a sign of a ministroke, known as a transient ischemic attack. While brief, it's important to get it checked out to rule out a serious underlying condition that could lead to a more severe episode later.

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